



'সমানো মন্ত্র: সমিতি: সমানী'

UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 1st Semester Examination, 2022

CC1-CHEMISTRY**INORGANIC CHEMISTRY****NEW AND OLD SYLLABUS**

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.***GROUP-A**

1. Answer any **five** questions from the following: 1×5 = 5
- (a) How many nodal planes are present in $3d_{x^2-y^2}$ and $3P_z$ orbital? 1
- (b) Why does thallium form an iodide only in +1 oxidation state? 1
- (c) Why dipole moment of CCl_4 is zero? 1
- (d) Why does He_2^+ exist but not He_2 ? 1
- (e) What is the structure and hybridization of PCl_5 ? 1
- (f) Why does MgO has a much higher melting point than NaCl? 1
- (g) Cite an example of organic redox indicator. 1
- (h) Which has more bond angle NH_3 or PF_3 ? 1

GROUP-B

2. Answer any **three** questions from the following: 5×3 = 15
- (a) Derive the Schrödinger wave equation. 5
- (b) (i) State Aufbau Principle. 2
- (ii) The kinetic energy of an electron has been found to be $5.76 \times 10^{-15} J$. Calculate the wavelength associated with the electron. 3
(Mass of electron = $9.1 \times 10^{-31} kg$, $h = 6.626 \times 10^{-34} Js$)
- (c) (i) State Heisenberg's Uncertainty Principle and explain its significance. $2\frac{1}{2}$
- (ii) Calculate the Uncertainty in the velocity of an electron whose Uncertainty in Position is 0.1 nm. $2\frac{1}{2}$
(Mass of the electron = $9.1 \times 10^{-31} kg$)
- (d) (i) Discuss the role of Lattice energy in the solubility of inorganic substances. 2
- (ii) Draw the Born-Haber cycle for sodium chloride. Explain the terms. 3

- (e) Write short notes on: 2 $\frac{1}{2}$ + 2 $\frac{1}{2}$
- (i) Dipole-Dipole interaction
- (ii) Van der Waals forces.

GROUP-C

3. Answer any *two* questions from the following: 10×2 = 20
- (a) (i) Write the Postulates of Bohr's Theory. 3
- (ii) What are the differences between de Broglie matter wave and electromagnetic wave? 3
- (iii) What do you mean by wave-particle dualism? What is de Broglie Wavelength? 2+2
- (b) (i) What is the significance of the term "Orbital magnetic quantum number"? Draw the vector orientation of the m_l values corresponding to $l = 2$ in magnetic field. 4
- (ii) The free electron can never exist in the nucleus, if the Uncertainty Principle is true — Justify. 2
- (iii) Using VSEPR theory, explain the geometry of the following species: 2+2
- (A) BrF_3 (B) SO_2Cl_2
- (c) (i) State the basis of radius ratio rule for ionic compounds. Calculate the limiting radius ratio for tetrahedral lattice structure. 4
- (ii) The drop in ionisation energy for N to O is larger than that for P to S. Explain. 2
- (iii) Discuss the MO theory of NO molecule. 4
- (d) (i) Establish Nernst equation for the following redox couple $\text{MnO}_4^-/\text{Mn}^{+2}$ in acid medium. 2
- (ii) Explain the effect of Polarizing Power and Polarizability of the properties of ionic compounds. 3
- (iii) State and explain Bent's rule and hence discuss the shape and bond angles in CH_2F_2 molecule. 3
- (iv) What is meant by Partial ionic character of a covalent bond? What are its consequences? 2

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